

Results of bacteriological analyses

Bacteriological analyses of water from 65 wells (sampled wells indicated in table 1) were made by the Montana State Department of Health; analyses were for the coliform group by the bacteriological fermentation tube test (U.S. Public Health Service, 1962). Cased, drilled or driven wells were sampled throughout the valley. Ten of the 65 samples indicated the presence of organisms of the coliform group. Five of the 10 wells were resampled and the samples analyzed to detect the presence of fecal coliform bacteria, an indication of recent contamination of water by human or animal wastes. Results of all five analyses were negative, suggesting that the original samples may have been contaminated because of sampling techniques or because the wells were improperly sealed.

Trace elements

Trace element analyses of samples from 10 wells are presented in table 4. Concentrations of arsenic, copper, lead, and zinc approached the limits recommended by the U.S. Public Health Service for drinking water used on interstate carriers. Because of the limited number of samples, unknown natural background levels, and the many opportunities for contamination of the sample by metal from the pump or well casing, little can be concluded about the distribution of trace elements in the ground water. The analyses, however, provide background data that can be compared with future data to detect changes with time.

Table 4.--Trace elements in water samples from wells

(Concentrations in micrograms per liter)

Location	Depth of well (feet)	Date of collec- tion	Arsenic (As), dissolved	Cadmium (Cd), dissolved	Chromium (Cr), dissolved	Cobalt (Co), dissolved	Copper (Cu), dissolved	Lead (Pb), dissolved	Mercury (Hg), dissolved	Nickel (Ni), dissolved	Zinc (Zn), dissolved	Temperature (°C)
10N2W19aad	74	9-09-71	20	<1	<1	<1	80	<1	0.3	<1	10	14.0
10N2W29bcc	80	9-10-71	<1	<1	<1	4	14	<1	.2	2	390	14.5
10N2W31aba	--	9-10-71	<1	<1	<1	<1	80	<1	.3	<1	220	15.0
10N3W11cca	40	9-09-71	<1	<1	<1	<1	290	<1	.2	4	90	15.0
10N3W12aaa	35	9-10-71	5	<1	<1	<1	530	<1	.3	2	310	15.5
10N3W24cbd	60	9-09-71	<1	<1	<1	<1	150	<1	.3	<1	70	16.0
10N3W25bbb	60	9-10-71	1	<1	<1	<1	44	<1	.3	<1	350	16.0
10N3W26ccd	44	9-09-71	<1	<1	<1	<1	54	20	.2	<1	60	17.0
11N3W31dda2	54	9-09-71	7	<1	<1	4	14	<1	.3	4	30	18.0
11N3W36ccd	45	9-10-71	6	<1	<1	<1	660	<1	.3	2	2700	14.5

Summary

With few exceptions, ground water in the Helena valley is of good quality. Despite locally high dissolved-solids content, the water is suitable for drinking according to standards recommended by the U.S. Public Health Service (1962) for drinking water used on interstate carriers. Contamination of ground water by coliform bacteria and by constituents indicative of man's activities is presently (1972) not a general problem.

The distribution of chloride and nitrate in the Helena valley is a result of at least three closely interwoven factors: source of the constituent, direction of water movement, and rate of water movement in the aquifer. The areal distribution of nitrate indicates that the sources of the nitrate are within the valley. With the exception of the two areas centered in agricultural parts of the valley, areas of highest nitrate concentrations correspond with areas of dense population.

The background data are too few to indicate whether the quality of ground water in the valley has changed with time. As long as development of the valley continues without public sewer or water facilities, it is important to monitor the water quality in order to detect problems before they become severe. It is possible that increased numbers of septic tanks, the raising of livestock within or adjacent to residential tracts, and the application of nitrogen fertilizers could result in the degradation of the quality of the ground water to a point at which a potential health hazard is created. Once that point is reached, upgrading ground-water quality may not be a simple process.

Additional data are needed to monitor and evaluate water quality in the Helena valley. These data could be obtained by:

1. Establishing a monitoring system of sampling locations selected on the basis of the nitrate and chloride distribution maps and sampling the wells at least once a year to determine if water quality degrades with time.
2. Analyzing water samples from specific depth intervals in test holes drilled especially for this purpose to determine water-quality variations with depth.
3. Studying the geology of the basin-fill deposits and hydrologic properties of the aquifer in order to better describe ground-water movement and quality.

References

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Glossary

Definitions of terms are derived from American Geological Institute (1962) and Lohman and others (1972).

Aquifer--Stratum or zone below the surface of the earth that contains sufficient permeable material capable of yielding significant quantities of water to wells and springs.

Evapotranspiration--A term describing that part of water returned to the air by evaporation and by transpiration of vegetation.

Hardpan--A hard impervious layer, composed chiefly of clay, cemented by relatively insoluble materials.

